Fundamental symmetries and the Dark Sector

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"Fundamental symmetry" refers to invariance of the laws of Nature, including the values of fundamental constants, with respect to a continuous or discrete transformation such as translation in space or time, rotation, spatial (P), time (T), or charge (C) reversal, combinations of these, or permutation of identical quantum particles. All discrete symmetries except for the combined CPT and the permutation symmetry are experimentally known to be violated by the weak interactions; intense searches are conducted for possible small violations of the still-standing discrete as well as the continuous symmetries, which may result from exotic beyond-the-standard-model interactions. In this talk, I will describe some of the recent fundamental-symmetry tests involving our research group (for up-to-date bibliography see `http://budker.berkeley.edu/PubList.html`), including measuring the effect of the gravitation-field gradient on the value of the fine-structure "constant," and searching for transient and oscillating effects on atomic magnetometers and clocks. The apparent time-dependent symmetry violations may, in fact, be manifestations of feeble interactions with the particles and fields that are possible constituents of dark matter and dark energy, the Dark Sector.